E1.04: NASA Lunar Concrete Mixer

TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

Executive Summary

Lunar Concrete Mixer engineered for the Designed for **geopolymer concrete 'moon brick' production** using **lunar regolith simulant**.

Our **electrical team** has **redesigned the Arduino-based control system** to improve integration with **sensors, switches, and motors.**

Operator Flow Code

Subsystem Purpose

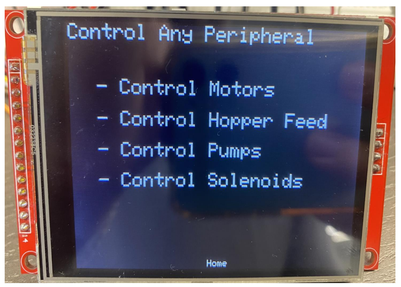
Processes user inputs into automated sequences, executing tasks in the defined order for efficient system control.

User Interface	• Reads in operator inputs such as operation sequence, runtime specifications, and motor/activator RPM settings.
Operation Sequencing	• Manages processes to ensure efficient operation within predefined tolerances by organizing tasks in a logical order.
Data Logging	• Records sensor data and operational actions every second to an SD card for monitoring and analysis.

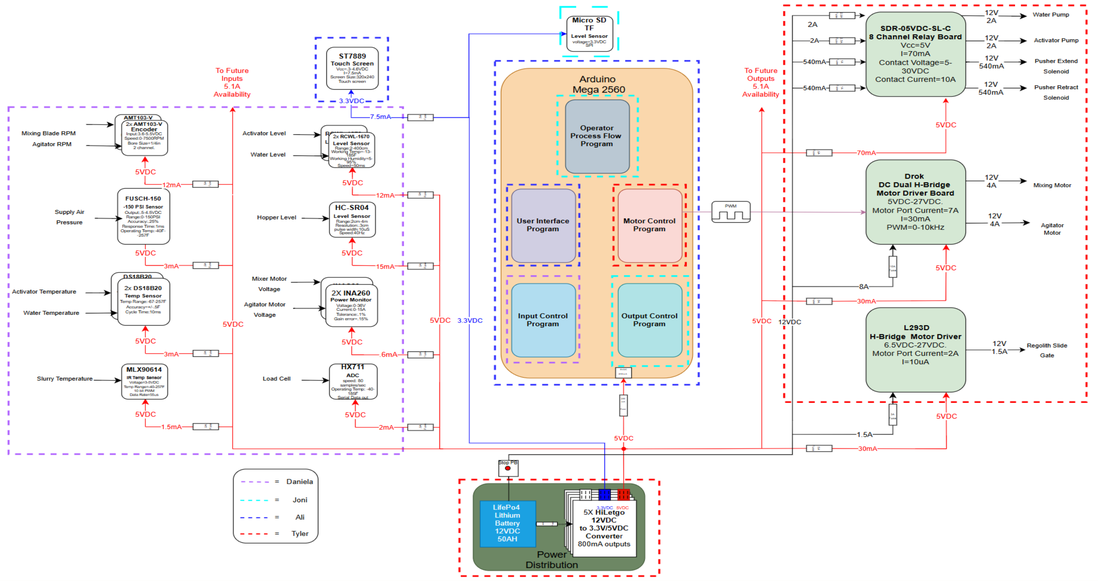
User Interface

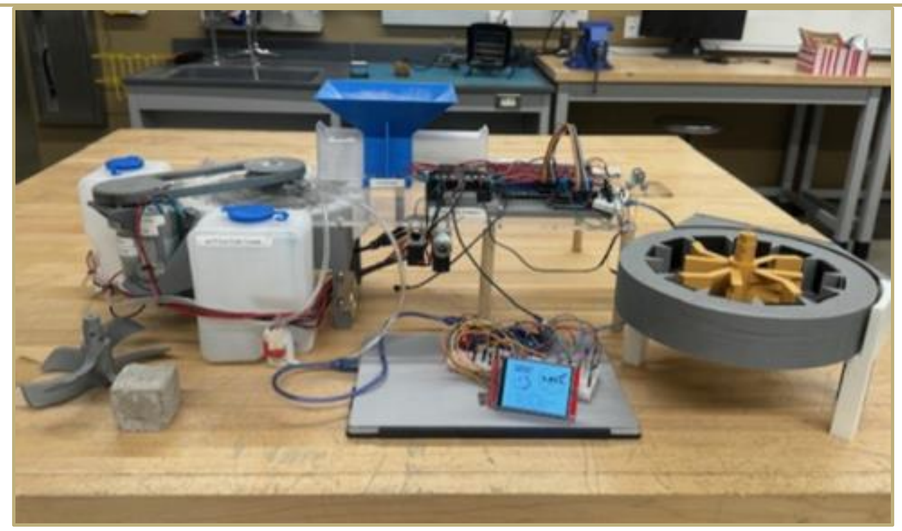
The touch screen User Interface gives users an easy way to **control and monitor peripherals** on the lunar mixer.

Allows users to test various **"recipes"** by adjusting **cure times, mixing speeds, and material quantities** such as water and activator.



Main Block Diagram

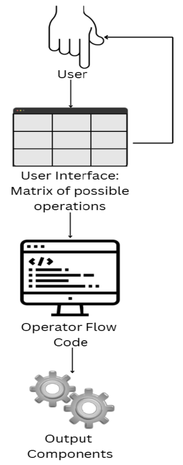




Lunar Concrete Mixer at the Start of Senior Design I

Steps for Automated Control:

- **Step 1** • The user sets up the operation sequence through the interface, specifying hopper feed, pump runtime, and motor RPM.
- **Step 2** • The user can press **Back** to modify steps or **Clear** to reset the process.
- **Step 3** • The **Operator Flow Code** executes the steps in the specified order.
- **Step 4** • Sensor data and operations are logged every second to an SD card once the process starts.
- **Step 5** • The user can press **Stop** anytime to halt the process.
- **Step 6** • The process stops automatically after all steps are completed, and logged data is available for review.



Left to Right: Joni McCawley, Daniela Salazar, Tyler Nuckols, Ali Kobeissi

Sensor Monitoring

Description	MIN	MAX
ULTRASONIC DISTANCE SENSOR	0 cm	11 cm
Fuchs 150 PSI pressure Sensor	0 PSI	150 PSI
BoJack DS18B20 Temperature sensor	-64 F	257 F
MLX90614 IR Temp. sensor	-40 F	257 F
Load Cell	3 Kg	2000 Kg

Power Management

Subsystem Purpose:

- The purpose of this subsystem is to adequately power the devices used to monitor and provide functionality to the mixer, as well as provide safety integration to the equipment.

Requirements:

•The power management subsystem will be capable of supplying 12VDC to the motors, 5VDC to the sensors, and 3.3VDC to the user interface and the data log.

D2 Plan

- Integrate and test the operator flow code and extend data logging functionality to support automated operation.
- Provide UI support for the operator flow code, manual control mode, and real-time monitoring of all sensors.
- Install and commission the sensor mounting brackets for optimal performance.
- Achieve full implementation of the mixer's electrical control system for the NASA Minds Competition.

Objective	Date
Individual Subsystems Built	February 3rd
System Integration	February 9th
Begin testing subsystems	February 17th
System Level Debug Completed/Begin Testing	February 24th
End testing subsystems	March 19th
Final Test Pass	March 22nd
Final Design Complete/NASA MINDS	March 25th